SCIENTIFIC ANALYSIS OF ROAD TRAFFIC ACCIDENTS

DISSERTATION SUBMITTED FOR

M.S. DEGREE (BRANCH II) ORTHOPAEDIC SURGERY

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The Tamilnadu Dr.M.G.R. Medical University

Chennai

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BONAFIDE CERTIFICATE

This is to certify that the dissertation entitled "SCIENTIFIC ANALYSIS OF ROAD TRAFFIC ACCIDENTS" is a bonafide record work done by Dr.M.CHANDRASEKARAN, under the guidance of Prof.Dr.M.Chidambaram in the department of Orthopaedics and traumatology Government Rajaji Hospital and Madurai Medical College, Madurai.

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DECLARATION

I, *Dr.M.CHANDRASEKARAN*, solemnly declare that the dissertation titled " *SCIENTIFIC ANALYSIS OF ROAD TRAFFIC ACCIDENTS*" has been prepared by me.

This is submitted to The Tamil Nadu Dr.M.G.R.Medical University, Chennai. In partial fulfillment of the requirements for the award of M.S.Degree Examination (Branch II) Orthopaedics to be held in March 2007.

Place: Madurai

Date :

Dr.M.CHANDRASEKARAN

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INTRODUCTION

Road traffic injuries are a major but neglected global public health problem, requiring concerted efforts for effective and sustainable prevention. Of all the systems that people have to deal with on a daily basis, road transport is the most complex and the most dangerous.

Worldwide, the number of people killed in road traffic crashes each year is estimated at almost 1.2 million, while the number injured could be as high as 50 million – the combined population of five of the world's large cities. The tragedy behind these figures regularly attracts less media attention than other, less frequent but more unusual types of tragedy. What is worse, without increased efforts and new initiatives, the total number of road traffic deaths worldwide and injuries is forecast to rise by about 65% between 2000 and 2020 (*1, 2*), and in low income and middle-income countries deaths are expected to increase by as much as

80%. The majority of such deaths are currently among “vulnerable road users– pedestrians, pedal cyclists and motorcyclists”. In high-income countries, deaths among car occupants continue to be predominant, but the risks per capita that vulnerable road users face are high.

Road deaths, disability and injury:

Every day around the world, almost 16,000 people die from all types of injuries. Injuries represent 12% of the global burden of disease, the third most important cause of overall mortality and the main cause of death among 1–40- year-olds (*3*). The category of injuries worldwide is dominated by those incurred in road crashes. According to WHO data, deaths from road traffic injuries account for around 25% of all deaths from injury (*4*). Estimates of the annual number of road deaths vary, as a result of the limitations of injury data collection and analysis, problems of

Leading causes of deaths by age group, world, 2002

Rank	0–4 years	5–14 years	15–29 years	30–44 years	45–59 years	≥60 years	All ages
1	Lower respiratory infections 1 890 008	Childhood cluster diseases 219 434	HIV/AIDS 707 277	HIV/AIDS 1 178 856	Ischaemic heart disease 1 043 978	Ischaemic heart disease 5 812 863	Ischaemic heart disease 7 153 056
2	Diarrhoeal diseases 1 577 891	Road traffic injuries 130 835	Road traffic injuries 302 208	Tuberculosis 390 004	Cerebrovascular disease 623 099	Cerebrovascular disease 4 685 722	Cerebrovascular disease 5 489 591
3	Low birth weight 1 149 168	Lower respiratory infections 127 782	Self-inflicted injuries 251 806	Road traffic injuries 285 457	Tuberculosis 400 704	Chronic obstructive pulmonary diseases 2 396 739	Lower respiratory infections 3 764 415
4	Malaria 1 098 446	HIV/AIDS 108 090	Tuberculosis 245 818	Ischaemic heart disease 231 340	HIV/AIDS 390 267	Lower respiratory infections 1 395 611	HIV/AIDS 2 818 762
5	Childhood cluster diseases 1 046 177	Drowning 86 327	Interpersonal violence 216 169	Self-inflicted injuries 230 490	Chronic obstructive pulmonary diseases 309 726	Trachea, bronchus, lung cancers 927 889	Chronic obstructive pulmonary diseases 2 743 509
6	Birth asphyxia and birth trauma 729 066	Malaria 76 257	Lower respiratory infections 92 522	Interpersonal violence 165 796	Trachea, bronchus, lung cancers 261 860	Diabetes mellitus 749 977	Diarrhoeal diseases 1 766 447
7	HIV/AIDS 370 706	Tropical cluster diseases 35 454	Fires 90 845	Cerebrovascular disease 124 417	Cirrhosis of the liver 250 208	Hypertensive heart disease 732 262	Childhood-cluster diseases 1 359 548
8	Congenital heart anomalies 223 569	Fires 33 046	Drowning 87 499	Cirrhosis of the liver 100 101	Road traffic injuries 221 776	Stomach cancer 605 395	Tuberculosis 1 605 063
9	Protein–energy malnutrition 138 197	Tuberculosis 32 762	War 71 680	Lower respiratory infections 98 232	Self-inflicted injuries 189 215	Tuberculosis 495 199	Trachea, bronchus, lung cancers 1 238 417
10	STDs excluding HIV 67 871	Protein–energy malnutrition 30 763	Hypertensive disorders 61 711	Poisonings 81 930	Stomach cancer 185 188	Colon and rectum cancers 476 902	Malaria 1 221 432
11	Meningitis 64 255	Meningitis 30 694	Maternal haemor-rhage 56 233	Fires 67 511	Liver cancer 180 117	Nephritis and nephrosis 440 708	Road traffic injuries 1 183 492
12	Drowning 57 287	Leukaemia 21 097	Ischaemic heart disease 53 870	Maternal haemorrhage 63 191	Diabetes mellitus 175 423	Alzheimer and other dementias 382 339	Low birth weight 1 149 172
13	Road traffic injuries 49 736	Falls 20 084	Poisoning 52 956	War 61 018	Lower respiratory infections 160 259	Liver cancer 367 503	Diabetes mellitus 982 175
14	Endocrine disorders 42 619	Violence 18 551	Childhood cluster diseases 48 101	Drowning 56 744	Breast cancer 147 489	Cirrhosis of the liver 366 417	Hypertensive heart disease 903 612
15	Tuberculosis 40 574	Poisonings 18 529	Abortion 43 782	Liver cancer 55 486	Hypertensive heart disease 129 634	Oesophagus cancer 318 112	Self-inflicted injuries 874 955

TABLE : 1

SOURSE: WHO GLOBAL BURDEN ON DISEASE PROJECT 2002

underreporting and differences in interpretation. The figure ranges from around 750,000 (*5*) (probably an underestimate, since it is made on the basis of 1998 data) to 1,183,492 annually – representing over 3000 lives lost daily .

Around 85% of all global road deaths, 90% of the disability-adjusted life years lost due to crashes, and 96% of all children killed worldwide as a result of road traffic injuries occur in low-income and middle-income countries. Over 50% of deaths are among young adults in the age range of 15–44 years (*6*). Among both children aged 5–14 years, and young people aged 15–29 years, road traffic injuries are the second-leading cause of death worldwide (see Table 1).

The road traffic death toll represents only the “tip of the iceberg” of the total waste of human and societal resources from road injuries. WHO estimates that, worldwide, between 20 million and 50 million people are

injured or disabled each year in road traffic crashes (the reason for the wide range of this estimate being the considerable, known underreporting of casualties) (*10*). Using epidemiological evidence from national studies, a conservative estimate can be obtained of the ratios between road deaths, injuries requiring hospital treatment, and minor injuries, as being 1:15:70 in most countries (*11–18*). In many low-income and middle-income countries, the burden of traffic-related injuries is such that they represent between 30% and 86% of all trauma admissions (*19, 20*).While a decrease in deaths due to road traffic crashes of some 30% is forecast in high-income countries, current and projected trends in low income and middle-income countries foreshadow a huge escalation in global road crash mortality between 2000 and 2020. Furthermore, on current trends, by 2020, road crash injury is likely to be the third leading cause of disability-adjusted life years lost (see Table 2).

ESTIMATED GLOBAL RESEARCH AND DEVELOPMENT FUNDING FOR

SELESCTED TOPICS:

TABLE 2

Disease or injury	***US$ millions***	***1990 DALYs ranking***	***2020 DALYs ranking***
HIV/AIDS	919 -985	2	10
MALARIA	60	8	
DIARRHOEAL DISEASES	32	4	9
ROAD TRAFFIC CRASHES	24 -33	9	3
TUBERCULOSIS	19 -37	-	7

DALYs: disability-adjusted life years. Source: reference *24*

The social and economic costs of road traffic injuries:

In economic terms, the cost of road crash injuries is estimated at roughly 1% of Gross National Product (GNP) in low-income countries, 1.5% in middle income countries and 2% in high-income countries (*5*) The direct

economic costs of global road crashes have been estimated at US$ 518 billion, with the costs in low-income countries – estimated at US$ 65 Billion – exceeding the total annual amount received in development assistance (*5*). Furthermore, the costs estimated for low-income and middle-income countries are probably significant underestimates. Using more comprehensive data and measurement techniques, the estimated annual costs (both direct and indirect) of road crash injury in European Union (EU) countries alone, which contribute 5% to the global death toll, exceed €180 billion(US$ 207 billion) (*9, 21*). For the United States of America, the human capital costs of road traffic crashes in 2000 were estimated at US$ 230 billion (*22*). If comparable estimates were made of the direct and indirect economic costs of road crashes in low-income and middle-income countries, the total economic cost globally of road crashes would be likely to exceed the current estimate of US$ 518 billion. The direct economic costs of global road crashes have

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The efforts required include (*25, 34*):

— A scientific approach to the topic;

— The provision, careful analysis and interpretation of good data;

— The setting-up of targets and plans;

— The creation of national and regional research capacity;

— Institutional cooperation across sectors.

The public health approach:

The public health approach to road traffic injury prevention is based on science. The approach draws on knowledge from medicine, biomechanics, epidemiology, sociology, behavioural science, criminology, education, economics, engineering and other disciplines. While the health sector is only one of many bodies involved in road safety – and usually not even the leading one – it nonetheless has important roles to play (see Figure 1).

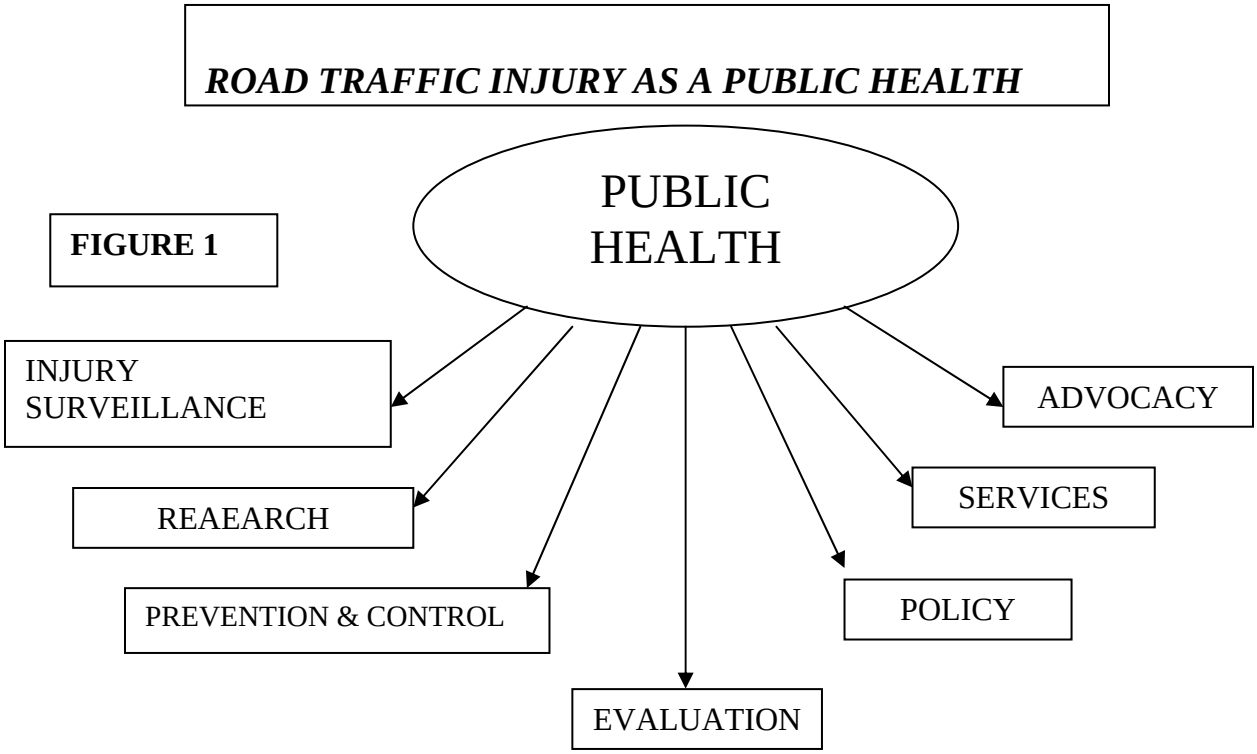


FIGURE 1

These include:

• discovering, through injury surveillance and surveys, as much as possible about all aspects of road crash injury – by systematically collecting data on the magnitude, scope, characteristics and consequences of road traffic crashes;

• researching the *causes* of traffic crashes and injuries, and in doing so trying to determine:

— Causes and correlates of road crash injury,

— Factors that increase or decrease risk,

— Factors that might be modifiable through interventions;

• exploring ways to prevent and reduce the severity of injuries in road crashes – by designing, implementing, monitoring and evaluating appropriate interventions;

• helping to implement, across a range of settings, interventions that appear promising, especially in the area of human behaviour, disseminating information on the outcomes, and evaluating the cost-effectiveness of these programmes;

• Working to persuade policy-makers and decision-makers of the necessity to address injuries in general as a major issue, and of the importance of adopting improved approaches to road traffic safety;

• Translating effective science-based information into policies and

practices that protect pedestrians, cyclists and the occupants of vehicles;

• Promoting capacity building in all these areas, particularly in the gathering of information and in research.

THE NEED FOR GOOD DATA AND SCIENTIFIC APPROACH:

Road traffic injury prevention is a highly politicized issue. Most people have their own opinions on what could make the roads safer. Anecdotal information and its reporting by the media all too often allow issues to be understood as major traffic safety problems requiring priority action, which in turn puts pressure on policy-makers to respond. Policy decisions for effective road injury prevention need to be based on data and objective information, not on anecdotal evidence. First, data on the incidence and types of crashes are needed. After that, a detailed understanding of the circumstances that lead to crashes is required to guide safety policy. Furthermore, knowledge of how injuries are caused and of what type they

are is a valuable instrument for identifying interventions and for monitoring the effectiveness of interventions. In many low-income and middle-income countries, systematic efforts to collect road traffic data are not well developed and underreporting of deaths and serious injuries is common.

GLOBAL IMPACT:

The road traffic injury problem began before the introduction of the car. However, it was with the car – and subsequently buses, trucks and other vehicles – that the problem escalated rapidly. By various accounts, the first injury crash was supposedly suffered by a cyclist in New York City on 30 May 1896, followed a few months later by the first fatality, a pedestrian in London (*3*). Despite the early concerns expressed over serious injury and loss of life, road traffic crashes have continued to this day to exact their toll. Though the exact number will never be known, the number of fatalities was conservatively estimated to have reached a cumulative total of 25

million by 1997 (*4*). WHO data show that in 2002 nearly 1.2 million people worldwide died as a result of road traffic injuries . This represents an average of 3242 persons dying each day around the world from road traffic injuries. In addition to these deaths, between 20 million and 50 million people globally are estimated to be injured or disabled each year (*2, 5, 6*). In the same year, the overall global road traffic injury mortality rate was 19.0 per 100 000 population (see Table 3). Low-income and middle-income countries had a rate slightly greater than the global average, while that for high-income countries was considerably lower. The vast majority – 90% – of road traffic deaths were in low-income and middle-income countries. Only 10% of road traffic deaths occurred in high-income countries.

TABLE: 3

Estimated global road traffic injury-related deaths

	Number	Rate per 100 000 population	Proportion of total (%)
Low-income and middle-income countries	1 065 988	20.2	90
High-income countries	117 504	12.6	10
Total	1 183 492	19.0	100

Source: WHO Global Burden of Disease project, 2002, Version 1 (see Statistical Annex).

In 2002, road traffic injuries were the ninth leading cause of disability-adjusted life years lost, accounting for over 38 million disability-adjusted life years (DALYs) lost, or 2.6% of the global burden of disease. Low-income and middle-income countries account for 91.8% of the DALYs lost to road traffic injuries worldwide. These observations illustrate the fact that low-income and middle-income countries carry most of the burden of the world's road traffic injuries.

REGIONAL DISTRIBUTION:

There is considerable regional variation, both in the absolute number of road traffic injury deaths and mortality rates . The WHO Western Pacific

Region recorded the highest absolute number of deaths in 2002, with just over 300,000, followed by the WHO South-East Asia Region with just under 300,000. These two regions together account for more than half of all road traffic deaths in the world. As regards death rates, the WHO African Region had the highest mortality rate in 2002, at 28.3 per 100 000 population, followed closely by the low-income and middle-income countries of the WHO Eastern Mediterranean Region, at 26.4 per 100 000 population (see Figure 3 and Table 3). The high-income countries in Europe have the lowest road traffic fatality rate (11.0 per 100 000 population) followed by those of the WHO Western Pacific Region (12.0 per 100 000 population). In general, the regional averages for low-income and middle-income are much higher than corresponding rates for high-income countries.

Road traffic trends:

According to WHO data, road traffic deaths have risen from approximately 999,000 in 1990 (*8*) to just over 1.1 million in 2002 – an increase of around 10%. Low-income and middle-income countries account for the majority of this increase. Although the number of road traffic injuries has continued to rise in the world as a whole, time series analysis reveals that road traffic fatalities and mortality rates show clear differences in the pattern of growth between high-income countries, on the one hand, and low-income and middle-income countries on the other (*2, 9–11*). In general, since the 1960s and 1970s, there has been a decrease in the numbers and rates of fatalities in high-income countries such as Australia, Canada, Germany, the Netherlands, Sweden, the United Kingdom and the United States of America. At the same time, there has been a pronounced rise in numbers and rates in many low-income and middle- income countries.

The reductions in road traffic fatalities in high-income countries are attributed largely to the implementation of a wide range of road safety measures, including seat-belt use, vehicle crash protection, traffic-calming interventions and traffic law enforcement (*2, 12*). However, the reduction in the reported statistics for road traffic injury does not necessarily mean an improvement in road safety for everyone. According to the International Road Traffic and Accident Database (IRTAD), pedestrian and bicyclist fatalities have decreased more rapidly than have fatalities among vehicle occupants. In fact, between 1970 and 1999, the proportion of pedestrian and bicyclist fatalities fell from 37% to 25% of all traffic fatalities, when averaged across 28 countries that report their data to IRTAD (*13*). These reductions could, however, be due, at least in part, to a decrease in exposure rather than an improvement in safety (*14*).

The GBD model predicts the following scenario for 2020 compared with 1990:

1. Road traffic injuries will rise in rank to sixth place as a major cause of death worldwide.
2. Road traffic injuries will rise to become the third leading cause of DALYs lost.
3. Road traffic injuries will become the second leading cause of DALYs lost for low-income and middle-income countries.
4. Road traffic deaths will increase worldwide, from 0.99 million to 2.34 million (representing 3.4% of all deaths).
5. Road traffic deaths will increase on average by over 80% in low-income and middle-income countries and decline by almost 30% in high-income countries.

DALYs lost will increase worldwide from 34.3 million to 71.2 million (representing 5.1% of the global burden of disease). According to the TFEC

model predictions , between 2000 and 2020, South Asia will record the largest growth in road traffic deaths, with a dramatic increase of 144%. If the low-income and middle-income countries follow the general trend of the high-income countries, their fatality rates will begin to decline in the future, but not before costing many lives.

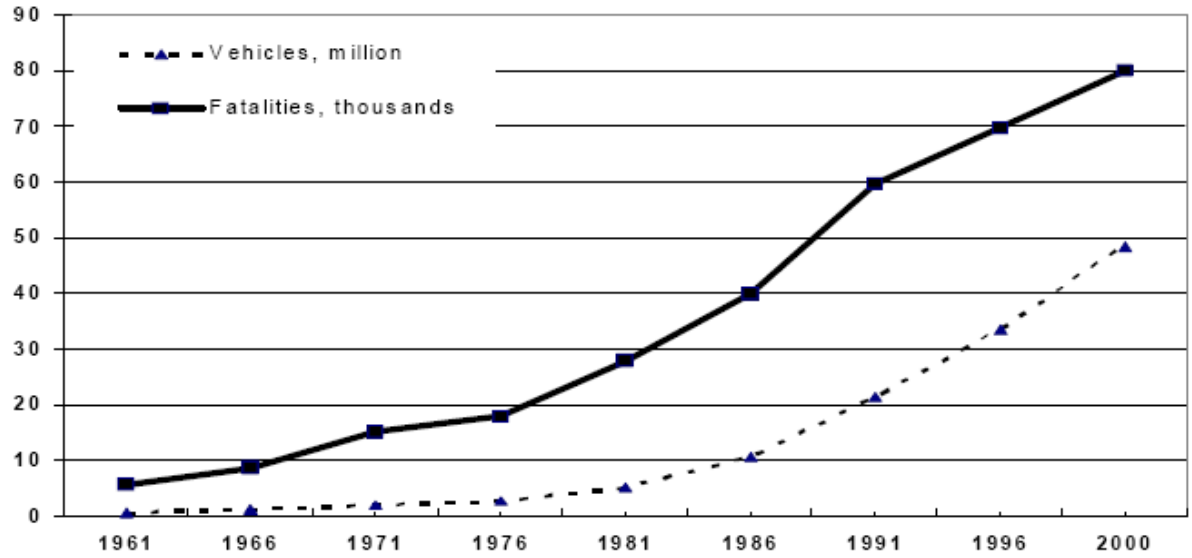
Road traffic trends have dramatically changed from the rising trend to the declining trend in high income countries in the phase of increase in the vehicles and transportation. On the other hand the trend in the low income and developing and under developed countries is on the increasing trend. This can be seen in the following figures 4,5,6.

ROAD TRAFFIC ACCIDENTS – INDIAN SCENARIO:

According to official statistics 80,118 persons were killed and 342,200 injured in road traffic crashes in India in the year 2000 (2). However, this is an underestimate, as not all injuries are reported to the police. The actual

numbers are likely to have been in the region of 1,200,000 persons with injuries requiring hospital treatment and 5,600,000 persons sustaining minor injuries. The situation in India is worsening and RTI have been increasing over the past twenty years (Figure 1).This is partly due to the increase in the number of vehicles on the road and partly due to the absence of a coordinated official policy to control the problem. These data show that the number of fatalities have continued to increase at approximately the same rate of about five percent a year over the past two decades. The fatality rate per million vehicles has remained around 2 for the past few years, whereas, the rate per million population continues to increase and is around 80 at present.

FIGURE: 7



Growth of motor vehicle population and road traffic fatalities in India

India is experiencing a new phenomenon in road traffic patterns and crashes for which there is little precedence in the highly motorised countries (HMC). Here the same road space gets used by modern cars and buses, along with locally developed vehicles for public transport (three-wheeled scooter taxis), scooters and motorcycles, bicycles, rickshas, and animal and human drawn carts. The infrastructure design based on homogeneous traffic models, has failed to fulfill the mobility and safety needs of this mixed traffic.

Figure:8

Non-motorized transport (NMT) constitutes a significant share of the total traffic in Indian cities and almost all of them experience a relatively high proportion of bicycle traffic (Figure 2). The share of NMT at peak hour varies from 30-70% depending on the city and the road. The proportion of trips undertaken by bicycles range between 15 and 35 per cent, the share tending to be higher in medium and small size cities (3). The patterns of NMT use change with growth in city size. In most NMT dependent cities, bicycles are used for the entire trip (e.g., commuting, shopping). Every

motorized public transport trip involves access trips by NMT at each end. Thus, NMT including walking continues to play a very important role in meeting the travel demand in Indian cities.

INJURIES AND FATALITIES: NUMBERS AND PATTERNS

Estimate of injuries and fatalities

According to official statistics 80,118 persons were killed and 342,200 persons injured in road traffic crashes in India in 2000 (2). However, a study done in Bangalore shows that while the number of traffic crash deaths recorded by the police is reasonably reliable, the total number of injuries is grossly underestimated (4). According to this study, deaths were underestimated by 5% and the number injured who needed treatment in hospitals by more than a factor of two. In this study, the ratio of injured people reporting to hospitals to that killed was 18:1. It is important to note that even this ratio would be an underestimate as among those injured

many others would have taken treatment athome or from private medical practitioners.

Another detailed study done in Haryana (India) recorded all traffic-related injuries and deaths through bi-weekly home visits to all households in 9 villages for a year (5). This study showed that the ratio between critical, serious and minor injuries was 1:29:69. In 1998 in U.S.A. 41,471 persons were reported killed and 3,192,000 injured, giving a ratio of 1:77 for recorded fatalities: injuries. Other studies from HMCs for ratios between deaths:serious-injuries:minor-injuries give statistics of 1:13:102 (6) and 1:14:80 (7)

- According to recent data, Indian roads carry about 1% of the world's vehicles; but still it accounts for 10% of RTAs, which is highest for any country in the world.

- *The major reasons implicated are (46):*

    - ❖ Wrong roads and curves
    - ❖ Road encroachments
    - ❖ Poor lightings
    - ❖ Poorly maintained vehicles and roads
    - ❖ Lack of reliable public transport
    - ❖ Lack of road education for both the motorist & pedestrian.

One reason is that health and technical professionals in India have not taken a scientific approach to this problem. In Australia, Europe and north America, many of the pioneers in road safety research came from the health profession. In India we do not have many surgeons or physicians who have taken up the cause of road safety in a scientific and consistent manner.

With these back ground our study aims at analyzing the road traffic accidents in a scientific manner.

AIM

To analyze the selected SCIENTIFIC PROFILES of ROAD TRAFFIC ACCIDENTS.

MATERIALS AND METHOD:

Study place – Government Rajaji Hospital, Madurai Medical college, in the Department of Orthopaedics & Traumatology

Study Period - July 2004 to June 2005

INCLUSION CRITERIA:

All the patients attended GRH Madurai with an history of RTAs.

EXCLUSION CRITERIA: Injuries other than RTAs.

For the purpose of the study, good definition was sought and World Health Organization definition for road traffic accidents was taken.

Definition: An accident which take place on the road between two or more objects one of which must be any kind of moving vehicle*. [WHO]

Ethical clearance was obtained from the institution

Persons interviewed were the – victims of RTA, their relatives / attendees All patients who attended the department of orthopaedics with the history of road traffic accidents were interviewed using a pretested proforma and the data were collected and registered in the registry. In patients with normal conscious state data were directly collected from them once they were stabilized clinically. In cases where the patients general condition did not permit the data collection we collected the data from the attendees and later the same data were confirmed with the patients as their general condition permitted us to do so. All the collected data were fed into a computer which had a special software specially made for this study, containing the parameters which were used

to collect the data from the patients and the results were analyzed as

Sex distribution,

Age distribution,

Different road occupants,

Different vehicles in road traffic accidents

Nature of road traffic accidents

Time distribution,

Injury pattern,

Day distribution,

Mode of road traffic accidents,

Seat belt wearing,

Helmet wearing,

Alcohol consumption,

Using cell phones during driving,

Driving license.

TOTAL NUMBER OF VICTIMS ANALYZED WERE: 2641

RESULTS:

SEX DISTRIBUTION

Total number of Male victims of road traffic accidents were 1910 constituting 72% of the victms.

Total number of Female victims of road traffic accidents were 491 constituting 28% of the victims.

AGE DISTRIBUTION:

In our study we grouped the patients according to their age group into eight groups as <15 years, 15 -20 yrs, 21 -30 yrs, 31- 40 yrs, 41 – 50 yrs, 51 – 60 yrs, 61 – 70 yrs, > 70 yrs. [Table 4 and figure 7]

TABLE :4

S.NO	AGE GROUP	VICTIMS IN NO.	PERCENTAGE
1.	<15	240	9.2%
2.	15 -20	183	6.5%
3.	21-30	718	27%
4.	31-40	595	22.5%
5.	41-50	396	15.4%
6.	51-60	321	12%
7.	61-70	161	6%
8.	>7O	27	1%

About 65% of RTA victims were between 20 & 50 years of age.

Road occupants:

Pedestrians formed 46 % (1215) of the victims of RTAs. Among these,

26% were injured by four wheelers,

14% by the two wheelers,

6% by the three wheelers.

Remaining 54% were the victims of bicycles, two wheelers, and three wheelers and four wheelers.[figure 8]

VEHICLES IN RTA:

Total number of vehicles involved in our study was found to be 3030 .

[table 5, figure 9]

TABLE : 5 ***VEHICLES PATTERN IN RTA***

VEHICLES		***NUMBER***	***PERCENTAGE***
TWO WHEELERS:	NON MOTORISED	287	9%
	MOTORISED	855	28.2%
THREE WHEELERS:	NON MOTORISED	12	<0.5%
	MOTORISED	233	7.5%
FOUR WHEELERS		1613	53%
BULLOCK CART		30	<1%
TOTAL		3030	

NATURE OF RTAs

Accidents between two wheeler and four wheeler accounted 31.6% which was followed by accidents between four wheeler and pedestrian.

[table 6, figure 10]

TABLE: 6

S.NO	***Nature of RTA***	***Percentage***
1.	Pedestrian V 2 wheeler	20%
2.	Pedestrian V 4 wheeler	26%
3.	2 wheeler V 2 wheeler	9%
4.	2 wheeler V 4 wheeler	31%
5.	4 wheeler V 4 wheeler	14%

TIME OF OCCURRENCE

Peak hours of RTAs were between 12pm – 3pm hours which accounted for about 20% of road traffic accidents.[table 7, figure 11]

TABLE: 7

S.NO.	*HOURS*	*PERCENTAGE*
1.	00 – 03 am	6%
2.	03 – 06 am	4%
3.	06 – 09 am	13%
4.	09 – 12 pm	16%
5.	12 – 03 pm	20%
6.	03 – 06 pm	17%
7.	06 – 09 pm	14%
8.	09 – 00 pm	10%

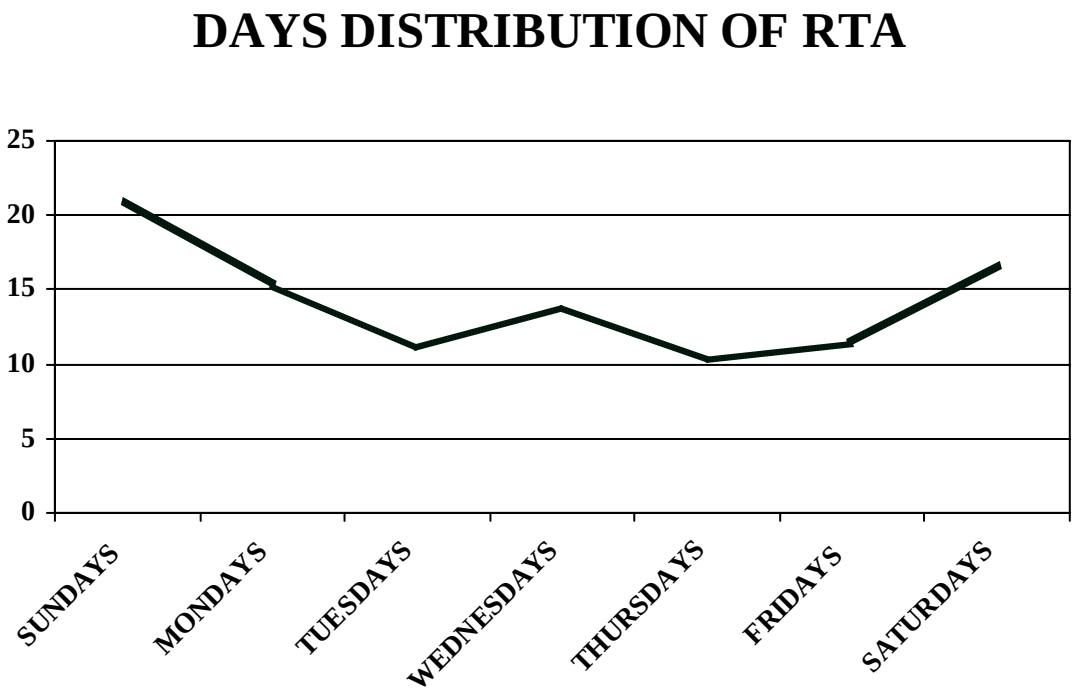
Days distribution:

Highest number of RTAs was on SUNDAYS 21% [table 8, figure 12]

TABLE : 8

S.NO.	*DAYS*	*PERCENTAGE*
1.	SUNDAYS	21%
2.	MONDAYS	16.7%
3.	TUESDAYS	11.4%
4.	WEDNESDAYS	10.3%
5.	THURSDAYS	13.9%
6.	FRIDAYS	11.1%
7.	SATURDAYS	15.3%

FIGURE : 12



MODE OF INJURY

Common mode of sustaining injury in our study was knocked down by a Vehicle which accounted for about 80% of road traffic accidents. Other modes of sustaining injury in road traffic accidents were head on collision, fall of a vehicle with resultant accident of another vehicle.[table9, figure 13]

TABLE:9

S.NO.	MODE OF INJURY	PERCENTAGE
1.	KNOCKED DOWN	80%
2.	RTA FROM FALL	4%
3.	HEAD ON COLLISION	16%

PATTERN OF INJURIES:

Multiple injuries dominated our study accounting for more than 50% of victims in road traffic accidents. Among the individual injuries long bone injuries predominated accounting for more than 30% of victims.[table 10]

TABLE 10

S.NO	***INJURY PATTERN***	***NO.***	***PERCENTAGE***
1.	HEAD INJURY	137	5.2%
2.	LONG BONES	923	35%
3.	THORACIC INJURY	337	12.8%
4.	SMALL BONES	655	24.8%
5.	PELVIC BONE	83	10.7%
6.	ABDOMEN	86	3.3%
7.	MULTIPLE INJURIES	1465	55.5%

DRIVING LICENSE

Among two wheelers about 10% were found not having driving license.

Among four wheelers about <1% were found not having driving license.

CELL PHONE USERS

Among two wheelers 9% were using cell phones at the time of RTAs

Among four wheelers 1% were using cell phones at the time of RTAs

ALCOHOL CONSUMPTION

About 3% of the victims of the two wheeler and 9% of the victims of the four wheelers were found to have consumed alcohol.

HELMET WEARING:

Among the two wheelers only 6% of the victims had helmet at the time of road traffic accidents.

SEATBELT WEARING:

None of our victims of four wheelers had seat belt on at the time of road traffic accidents.

DISCUSSION :

Our study has showed that the major victims of road traffic accidents were men accounting for about 72% which indicates that our community set up which predominantly depends on male population.

Our study has showed highest number of victims of road traffic accidents in the age group between 20 – 30 years accounting for about 27% that is more than one fourth of the total victims of our study. This is followed by the age group between 31- 40 years accounting for 22.5%. These two age groups constitute almost 50% of road traffic accidents which is very high. These are the age group in which most family's bread winner will be. This is the most active and productive age group of the community. Injury involving this age group would seriously affect the economic status of the family, community and the country. Accidents below the age group of 15 were less; likewise accidents above the age group of 60 & above were

also less indicating that these are the less mobile population of the community and both these group of population will be taken care by the parents in case of children and the sons and daughter for those above the age of 60.

The similar findings were also reported from Delhi and Nepal also (35,36) However in few studies 16 – 30 years and 15 – 35 years age groups were more involved in RTA (37,38). Another study from Delhi, reported that people of the third decade of age were most commonly involved in RTAs(39) .

ROAD OCCUPANTS:

Our study has shown that pedestrians were the major number of victims accounting for about 46% of RTA victims. This reflects both the quality of vehicle drivers and the pedestrians. Pedestrians do not use the sidewalks and pedestrian crossings regularly, even if it is present. In many

occasions in our study pedestrian walk was found to be absent. Even if it was found to be present, it was occupied by the road side shops, etc. our study has also found that pedestrian had inadequate pedestrian crossing and not using the pedestrian crossing in many occasions. Pedestrians were directly exposed to the force of the vehicle;

Similar results were also observed at other places(35,37,40,41).

VEHICLES IN RTA:

In our study we found total number of vehicles involved were 3030 in which four wheelers were found to be involved in more than 50% of cases. This indicates four wheelers were dominating in the roads and the road infrastructure in and around Madurai has not changed much in the past 50 years and the same old road infrastructure is still in use without giving much attention to the ever-increasing road vehicles and road traffic accidents.

NATURE OF THE ROAD TRAFFIC ACCIDENTS:

Accidents between the four wheelers and two wheelers constituted 31% of the road traffic accidents in our series and this was followed by the accidents between the four wheelers and the pedestrian constituting about 26% of the road traffic accidents in our series and this was followed by the accidents between the pedestrian and the two wheelers which accounted for about 20% of the accidents. This can be explained as same as mentioned in the above columns of pedestrians and different vehicles in RTA.

TIME OF OCCURRENCE:

Our study has shown the peak hours of road traffic accidents between 12 – 3 pm accounting for about 20% that is one fifth of road traffic accidents. This was followed by 3 – 6 pm which accounted for about 17% and this

was closely followed by 9am – 12 pm which accounted for about 16%. This can be explained as follows:

During the lunch time everyone tend to have a small period of drowsiness in the post lunch period and if this happens to the drivers then they are prone to meet with an accident. This is what is known as failure of “BIO – ADAPTATION”. The noon time is the time period where the four wheelers movement will be high. 3 – 6 pm and 9 am – 12 pm were the busiest schedules for the community people to move to their schools, offices and for other purposes and the same group of people will be returning back to their homes in the evening time period. Hence these two time periods that is between 3 – 6 pm and 9 am – 12 pm has to be considered the busiest time periods of the community as far as our study is concerned and resulted in more number of accidents. Though people will be more brisk in the morning time, they will be in a hurry and this makes them to commit mistakes during these time period. In the evening, people

will be more tired from their office and school work and tend to have less attention making themselves vulnerable to the road accidents.

More than 65% of road traffic accidents took place in the day time (6am to 6 pm). Similar results were also observed in Delhi and Pondicherry (35,42)

DAYS DISTRIBUTION:

Our study has showed maximum number accidents on Sundays accounting for about 21%. This was followed by accidents on Mondays and Saturdays constituting next major days for accidents. These three days almost constituted more than 50% of the road traffic accidents. This could be explained as follows:

During the weekends families tend to go out for relaxation, shopping, etc.

Many people working outside the district, state may return to their homes and return back to work places at the week ends resulting in increased population migration in and around the district.

This pattern of involvement of RTA is different from other studies such as from Delhi, California(35,43). The similar finding has been observed from a study from Pondicherry (42).

MODE OF INJURY:

In this study the common mode of sustaining injury was found to be knocked down by a vehicle which constituted the major number of traffic accidents accounting for about 80%. This is followed by traffic accidents from fall of a vehicle while moving on road and resulting in accidents, and

head on collision.

Similar findings were also observed in the studies from Delhi and

Pondicherry(35,42)

This can be explained as follows:

As far as Madurai and the surrounding areas are concerned the traffic

system itself has not fulfilled the requirement of the population, having

small roads, inadequate side walks for the pedestrians, inadequate

pedestrian crossings, etc.

PATTERN OF INJURIES:

In this study multiple injuries has dominated accounting for more

than 55% of road traffic accidents which was followed by injuries to the

long bones and small bones accounting 35%, 24.8% respectively. When considering the individual injury pattern injury to the long bones of the body were found to be at highest risk accounting for more than one third of cases in our series. Amongst these long bones injuries, bones of the lower limbs accounted more than 50% of injuries accounting 24%. This was followed by the injuries to the long bones of the upper limbs accounting for about 11%. Among the injuries to the small bones, the small bones of the foot accounted for maximum number of cases – 16% and this was followed by the injuries to the small bones of upper limb.

Among the long bone injuries which accounted for about 35% of the cases in our series, the open injuries were found in about 26% of cases. Open

injuries predominated in the lower limb than in upper limbs in a ratio of about 2.5 : 1. Tibia was the long bone which sustained maximum number of open fractures. More than 90% of Tibial fractures were open fractures. This was followed by the open fractures of the forearm (5%), humerus(3%) femur(2%) .

Among the small bone injuries, foot injuries accounted for maximum number of open injuries followed by the hand injuries.

This pattern of analysis of injuries in road traffic accidents is a new concept that has been adopted by us in this study.

DRIVING LICENSE:

In our study about 10% of the drivers of the two wheeler were found not

having driving license and about 1% of the drivers of the four wheeler were found not having driving license.

This study found 11% of drivers of different vehicles were without driving license, which is higher compared to 7.4% found in Delhi(35).

CELL PHONE USERS:

Among two wheelers 9% were using cell phones at the time of RTAs

Among four wheelers 1% were using cell phones at the time of RTAs

ALCOHOL CONSUMPTION

About 3% of the victims of the two wheeler and 9% of the victims of the four wheelers were found to have consumed alcohol during the accident.

In the present study 12% of the drivers involved in RTA had consumed alcohol. This is a higher proportion compared to 4.6% and 8% reported from Delhi(39,45).

HELMET WEARING

Among the two wheelers only 6% of the victims had helmet at the time of road traffic accidents.

No protective gear was used by many of the victims in this study, because there is no such law in Tamil Nadu or Pondicherry regarding the helmet use.

SEATBELT WEARING:

None of our victims of four wheelers had seat belt at the time of road traffic accidents.

All these above parameters indicates that the traffic rules and their implementation are not strict enough.

CONCLUSION:

Men are the major victims of road traffic accidents in the age group between 20 – 40 years accounting nearly 50% of the victims in our study. Among the road occupants pedestrians are the most commonly injured victims in our study accounting 46%. Our study has identified the people at major risk for road traffic accidents that is the vulnerable group. These are the target groups who needs active intervention to create awareness among them to prevent road traffic accidents and to promote health consciousness while driving a vehicle.

Among the vehicles involved in road traffic accidents four wheeler Vs two wheeler accidents accounted more than one third in our study. The peak hours of accidents in our study were between 12 pm – 3 pm. This can be used to create awareness among the vehicle drivers to be cautious during these hours apart from overall awareness. Among the days Sundays accounted more than one fifth of road traffic accidents in our study and this indicates that the general trend of population migration during the weekends. This can be used to create awareness among the people and the vehicle drivers informing them about the current trend of road traffic accidents in and around Madurai. The common mode of injury in our study is being knocked down by a vehicle which accounted for 80% of the road traffic accidents. In our study victims sustained multiple injuries accounted 55% which is quite a high percentage when compared with the older studies and this can used to asses the medical facilities that are needed to treat all these victims and the mortality and morbidity that can result from these accidents. Cell phone usage during driving has resulted in 10% of road traffic accidents in our study. 12% of victims of road traffic

accidents in our study were found to have consumed alcohol at the time of road traffic accidents. These indicates lack of overall awareness about the road traffic accidents and insufficiency of traffic regulatory system.

Thus our study has brought out some of the trends in the road traffic accidents in and around the Madurai city that can help the traffic regularization systems in the following ways:

1. **To create awareness among the more vulnerable populations as found in our study – men, people between 20 – 40 years, pedestrians.**
2. **To have a target oriented approach to create awareness in the short term**
3. **To create awareness among the community people in all age groups in order to reduce and to prevent the road traffic accidents in the long run.**
4. **Traffic rules are not strictly followed by the people. Hence strict enforcement of traffic rules.**
5. **There is no traffic rule to have compulsory wearing of helmet, seat belt, avoidance of cell phone usage during driving; hence these aspects of road traffic accidents has to be approached in a systematic manner to create awareness among the vulnerable population.**
6. **The future generation must get full awareness about the road rules, their violations and hazards so that road traffic accidents can be prevented in the long run. To achieve this road safety education has to be included in the curriculum.**

Road traffic safety is an outcome of interactions in integrated system of Roads, Road Users and Vehicles. Whenever harmony among the three

sub-systems is disturbed the chances of accident occurrence would increase. Any efforts to enhance the safety of road traffic operations should be based on an integrated approach to preserve and promote the harmony of these three subsystems. In comparison to developed countries the traffic accident characteristics and nature of accidents are considerably different in India. To enhance the road safety condition a large number of strategies can be employed but they need to be analyzed in terms of Indian conditions in order to acquire optimum benefits. Our study is such a kind of one and this can be used in planning the road safety measures like

1. **Improvements in the road infrastructure such as adequate pedestrian walks, removal of road encroachments etc.**
2. **Proper enforcement of traffic rules**
3. **Making new traffic rules as needed on today**
4. **Improving the driving skills of the drivers**
5. **improving the standards of the driving vehicles and their maintenance**
6. **Proper efforts to create awareness among the most vulnerable population in the short term and among the all age group people of the community so that road traffic accidents can be prevented in the long run.**

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PROFORMA:

Name: Age: Sex:

IP.NO: Date of Admission: Date of Discharge:

Mode of travel:

Nature of RTA:

Time of RTA:

Injury surveillance

S.No	Injured part	yes	No
1.	Head injury		
2.	Chest injury		
3.	Abdominal injury		
4.	Pelvic injury		
5.	Small bone injury		
6.	Driving license		
7.	Long bone injury		
8.	Alcohol consumption		
9.	Helmet wearing		
10.	Seat belt wearing		